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ADDITIONAL NOTICES.

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1. *Suez Canal, with Directions for its Pilotage.*

(Communicated by Capt. G. H. RICHARDS, R.N., Hydrographer to the Admiralty.)

THE following information has been received from Commander G. S. Nares, of Her Majesty's Surveying-vessel *Newport*, which vessel passed through at the opening, November, 1869:—

The coast in the neighbourhood of Port Said is unusually low, being out of sight at 3 miles distance. The lighthouse, town, and shipping are the only objects seen from the offing.

At present there are two tall obelisks, one on each side of the Canal entrance, but as they are merely built of boarding, they can only be temporary. At 6 miles to the west the coast is marked by Gemileti Tower—a low, square building standing by itself on a low sandy coast; but to the eastward of the port there is nothing to mark the low shore.

The current off the coast is very uncertain. It generally runs with the wind, from half to $1\frac{1}{2}$ knot an hour. The general set is to the eastward. Owing to the current and low shore, more than usual caution is necessary in approaching the harbour.

The harbour is formed by two concrete breakwaters running off from the sandy shore. Inside the piers the harbour is at present constantly silting up, in consequence of the current, heavily laden with sand, running through numerous openings in the piers, and depositing the sand in the quieter water inside.

A good, straight channel of 26 feet of water has been dredged, leading into the inner basins, about 100 yards inside, and parallel to the west pier. It is marked by black buoys on the east side, and red ones on the west side; and it may be presumed that the authorities will be careful to keep it clear.

The basins inside the harbour have a depth of 26 feet water; they are sufficiently large for the trade which may be expected. If not, there is ample space for enlarging them.

On the outer end of each breakwater there is a low light—*red* on the west pier, and *green* on the east one. The Port Said lighthouse is a tall white stone tower, 180 feet high, standing close to the inshore end of the west breakwater. It shows a flashing white lime-light, visible 18 miles. The pilot boats carry a blue peter flag.

The best anchorage in 6 fathoms is with the low red light on with the high lighthouse; or the west pierhead a little open of the lighthouse on either side. The bottom is mud and very good holding-ground. A bank with 12 feet water has been formed to the eastward of the harbour. The east pierhead light (*green*) on with the high lighthouse leads over the west edge of the bank; therefore these marks must be kept well open.

In approaching, allowance must be made for a bank which is forming outside the west pier end. In November, 1869, there was 6 fathoms at half a mile from the pier end, with the anchorage marks in one.

The entrance to the Canal is conveniently situated at the inner end of the basins.

The usual depth of water is from 26 to 29 feet; immediately south of the Campement de Cap is a short bank of 24 feet: and one mile north

of Kantara, opposite the 43rd kilometre mark, is a bank of 23 feet. The whole of this distance, $24\frac{1}{2}$ miles, with the exception of one-sixth mile at the Campement, which is higher, the Canal runs through a wet flat sandy plain, scarcely higher than the level of the water on the east side, and a little below it on the west side, which, with a "high Nile," is completely overflowed, and the sand rendered firm by the deposit of mud from the river. In this part of the canal there is no sand-drift, and it may be considered as completed. The *débris* thrown up on the banks is firm, black, sandy mud, protecting the Canal from the water in Lake Menzaleh, without any opening in the whole distance.

The Canal passes through sand-hills from 20 to 30 feet high, and has a depth of from 26 to 28 feet. This part of the Canal is completed, but it is subject to a severe sand-drift in high winds.

The Canal here passes through a lagoon, with a depth varying from 19 to 24 feet, but the dredges are still at work. There is constant trouble in this part of the Canal in consequence of the banks on each side, which are composed of fine sand *débris*, not being firm enough to resist the constant ebb and flow of the water between the lake and the canal, which, carrying large quantities of sand with it, is constantly altering the depth of water. In this cutting the sand-hills are about 40 feet high. The depth in the Canal varies from 22 to 24 feet, but there is work still going on in the shallow parts. All this part is subject to heavy sand-drift.

For about 4 miles in the neighbourhood of El Guisir the Canal is cut through a stratum of soft lime or sandstone. The sharp turns between El Guisir and Lake Timsah are probably owing to the engineers having followed the softest part of the rock. Ships can pass round the curves without trouble.

The central station in the Canal is well situated for a stopping-place. There is at present only 22 feet in the middle of the lake, but the dredges will soon give deeper water. The depth varies from 22 to 27 feet, except one bank of 20 feet in the Lagoon. The *débris* banks here, of pure sand, like those in Lake Ballah, are not adhesive enough to form a barrier between the Canal and the Lagoons, to keep the silt from running into the channel; but the Canal is sufficiently wide to allow dredges to work *without stopping the traffic*.

In this cutting the Canal is carried through a stratum of sandstone with depths from 22 to 24 feet, except in one place one mile south of Sérapéum, where, for about 30 yards, there is a narrow ridge with only 18 feet water over hard rock. A strong party of men are at work, and the obstruction will soon be reduced. At the south end of the cutting the deep channel is narrow and incomplete. This cutting is subject to a very heavy sand-drift. From the *débris* on the bank it would appear that the narrow ridge of stone running across the Canal had only lately been discovered.

The margin of the deep water in the Lake, $1\frac{1}{2}$ mile from the entrance, is marked on the east side by a red iron pillar-lighthouse 40 feet high, showing a fixed white light visible 10 or 12 miles.

The excavated channel leading into the deep water has a depth of from 24 to 29 feet. It is conspicuously marked on each side by iron beacons, 15 feet high, with a black ball, 3 feet in diameter, on the top. As we passed, each beacon was lighted, but whether the lamps are to remain could not be ascertained.

The margin of the deep water at the south end of the Lake is conspicuously marked on the east side by a lighthouse similar to the north one, and by a buoy on the west side.

A straight run may be made between the lighthouses (a distance of 8 miles) with not less than 22 feet depth of water; 26 feet may be obtained by passing nearer to the west shore of the Lake. The water in this part of the Lake being shallower, a cutting has been made giving from 26 to 27 feet depth. The channel is well marked by numerous iron beacons on each side (from 4 to 6

to a mile) similar to those at the north end of the Lake. This part is quite complete, with hard banks, and depths of water from 26 to 30 feet at low water. It is subject to sand-drifts.

At Chalouf the cutting is carried through sandstone; the *débris* is hard and lumpy.

South of latitude $30^{\circ} 6' N.$ the Canal passes through sand-hills; it increases in width, and the *débris* on the bank is more than usually large.

At Madama the banks are of firm marl or soft clay. This part of the Canal is incomplete; the *débris* banks are sand. The soundings were irregular, the depth varying from 21 to 26 feet at low water. A large number of men are still at work here.

At the entrance a good stone wall is built on the west bank, but it requires to be raised and extended. Another is much wanted on the east side, where the curve already shows the usual signs of scouring out on the outer and depositing on the inner side.

The south end of the Canal may be said to extend $1\frac{1}{2}$ mile beyond the two red lights, passing the Suez creek and the new dock and harbour works, into the Gulf of Suez with not less than 27 feet at low water. With a flood tide a great quantity of silt pours into the Canal from the sand-bank on the east side of the entrance, but doubtless means will be taken to prevent it.

A breakwater has already been carried across the sea face of the bank.

The mouth of the canal is marked by a *red* light on the west side at the extreme end of the new harbour works, and by a *green* light on the opposite side on the nearest end of the breakwater. Both lights are at present only hoisted on temporary poles. Outside these marks the channel is further shown by a line of buoys, white on the east side and red on the west side.

The dry dock is 430 feet long, 83 broad, and can dock a ship drawing 23 feet when the channel outside is completed.

The current depends on any variation in the height of the water in the Mediterranean. The banks shew that the Canal here is subject to a rise and fall of one foot, the current and height lessening as the distance from the entrance increases. There is no tide or current in Lake Timsah or the Upper Bitter Lake. The tidal influence extends from Suez to 4 miles north of the southern end of the Bitter Lakes. The stream commences to flow from 2 to 3 hours after low water at Suez.

A spring tide rises 6 feet at Suez, 2 feet at Madama, $1\frac{1}{2}$ at Chalouf, and half a foot at the south entrance of the Bitter Lakes. At Kabiet there is no rise and fall. The immense reservoir of water in the Bitter Lakes with an ebb-tide, and in the Gulf of Suez with the flood, will prevent the tide ever having a greater range.

With a strong southerly wind in the Gulf of Suez the water rises to from 8 to 9 feet at the head of the gulf, and may affect the water in the Canal to some small extent.

From 2 to 3 hours before high water at Suez the flood with a spring tide was running $1\frac{1}{2}$ knot at Chalouf, increasing to 2 or $2\frac{1}{2}$ knots at Madama, with the water very much discoloured.

By starting from Suez an hour before low water a vessel will arrive in the Bitter Lake before the flood tide overtakes her, and having nearly slack water all the way.

Every 5 or 6 miles a short widening in the Canal (a *gare*) gives room for a vessel to haul in and allow another to pass her with ease. Vessels can pass each other at any part by using warps, but they cannot do so without stopping, except at great risk of running on shore and delaying the whole traffic of the Canal. A single ship could pass through in from 14 to 16 hours; and two small ships, entering one at each end, could pass each other without slackening speed. But it is impossible to carry a train of large ships through in one day.

Lake Timsah and the town of Ismāīlia are conveniently situated and suffi-

ciently large for a stopping-place; and doubtless arrangements will be made for ships to start from each end on one day, for all to meet and anchor for the night at Lake Timsah and to start for their respective ends the following morning. This, allowing 8 hours for passing through each end of the Canal, and 12 hours for remaining at Ismäïlia, will give 28 hours for the transit.

With a full moon a handy ship, by entering the Canal in the evening and arriving at Ismäïlia in the morning early enough to join the train of vessels, might perform the voyage in from 16 to 20 hours. With a train of only two or three ships, and no delay at nights, the transit would occupy about 18 hours.

There is no doubt that every vessel will cause more or less damage to the banks on passing, but screw-ships only going 5 or 6 knots will hurt the Canal very slightly, except in the lagoons, where the banks are formed of very fine sand. The *Pera*, a large paddle-wheel steamer, on passing with great speed (8 knots), and displacing the water in the whole breadth of the Canal, did considerable damage, the wave she made swamping several boats. Large vessels should be made to reduce speed more than small ones.

Should a vessel touch the ground in any part of the Canal, except in the tidal part at the Suez end, she will sustain no damage, merely being thrown out of her turn in the line. A good coating of sand has formed at the bottom of the Canal in the sandstone cuttings.

In the tidal part near Suez, if a vessel is passing through with a following tide and the bow touches either bank, there will be great danger of her swinging across the Canal, with a 2-knot current running against her broadside. With a wind blowing across the Canal, vessels touching the lee side will be blown at once against the bank, but without any damage.

The present pilots will rapidly gain experience; with trained leadsmen and a lead going on each side of the ship there is no difficulty whatever in navigating the Canal and keeping in mid channel. Should a bank form, it will be at once detected, and ample means are ready for reducing it.

The precautions necessary are similar to those in any river, with the advantage of there being fewer and better curves, and nearly a straight course throughout.

Thirty-five miles of the Canal is subject to the sand drifting. One squall was experienced (force 6) when the drift was as thick as an ordinary fog, and most distressing to the eyes; so much so, that had the ship been in a curve at the time, there would have been great difficulty in keeping her in the proper channel. Fresh-water pipes run along the west bank of the Canal for the greater part of its length, and doubtless, as soon as the water is no longer required for the engines, it will be used to irrigate the banks and endeavour to stop this nuisance.

In the total 86½ miles, 65 may be considered as quite completed. Throughout the remaining 21½ miles there is either dredging or embanking work still going on. For 5 miles in the worst parts of Lake Ballah and the Lagoons south of Lake Timsah constant dredging will be required, until means are found to keep the banks solid enough to prevent the waters communicating.

In the Sérapéum cutting there is a rocky ridge of a few yards with only 18 feet water upon it, which will soon be removed. Except for about 10 miles there is 24 feet of water throughout the canal. Vessels drawing 17 feet can pass through with ease. When the barrier at Sérapéum is removed the Canal will be open to ships drawing 20 feet.

The largest ship that passed through the Canal at the opening was the *Peluse*, Egyptian yacht, drawing 16 feet, about 250 feet long. Several ships grounded on the passage, but all got off again with a little delay. The grounding was caused more by the desire of the 40 or 50 ships to get quickly through, than through any fault in the Canal.

GEO. HENRY RICHARDS, Hydrographer.